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Prevalence of knee pain differs across ecological landscapes of the Western Development Region of Nepal

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Abstract

Objectives

To estimate knee and chronic knee pain prevalence in the adult population of one region of Nepal and compare rates across plain, hilly and mountainous landscapes.

Methods

A cross-sectional multistage cluster survey was undertaken in seven sites across the Western Development Region of Nepal. Regional and zonal weighted 12-month prevalence rates of knee and chronic knee pain were estimated. Logistic regression was used to investigate if ecological landscape was an independent risk factor for knee pain and/or chronic knee pain.

Results

The weighted 12-month prevalence of knee pain was 21.5% (95% CI 18.3% to 23.9%) in the 694 recruited participants, about half had chronic knee pain (10.9%, 95% CI 7.3% to 12.4%).

Conclusions

Living in a mountainous landscape was an independent risk factor for both knee and chronic knee pain.

Keywords:
knee pain, ecological, landscapes, chronic knee pain, prevalence

INTRODUCTION

Knee pain is a common musculoskeletal condition worldwide, particularly in older adults, and is one of the commonest causes of disability (1, 2). There have been numerous international studies, which have established the prevalence of knee pain in different countries and regions (3, 4), but there has to date been limited research undertaken in the Nepalese population. Rates of knee pain in the Nepalese population may not be influenced so much by known risk factors, such as obesity, of which more developed countries are prone (5, 6), but a high proportion of the population work in agriculture and squatting is a common posture while undertaking tasks such as washing clothes, preparing food, and during toileting (7, 8). This may increase knee pain prevalence because of overload and overuse injury. Furthermore, ecologically Nepal is divided into three broad divisions: the plain landscape (60 – 1000 m), the hilly landscape (1001 – 3000 m), and the mountainous landscape (above 3001 m). These ecological landscapes are parallel to each other, stretched from east to west comprising 23%, 42% and 35% of the national land area with 51%, 43% and 7% of population in plain, hilly and mountainous ecological landscapes respectively (9, 10). The prevalence of knee pain may differ across the different ecological landscapes because of the impact on the knee while performing tasks in more rugged and steep terrains. Sakakibara et al. showed higher rates of knee pain among men (but not women) living on steep mountainous slopes in Japan (7).

However, the only Nepalese studies published to date have been small and neither were undertaken in the mountainous landscape (11). This study was undertaken to estimate an overall period prevalence of knee pain in one Development Region of Nepal and to investigate the impact of residence in different landscapes on knee pain and chronic knee pain in this population.

METHODS

A cross-sectional multistage cluster survey using an investigator-administered questionnaire.

Participants and study sites

This study was undertaken among adults (aged 18 or over) residing in the Western Development Region of Nepal between November 2013 and May 2014. This is one of five Development Regions in Nepal. The study was limited to the Western Development region and specific districts within this region on advice from the Ministry of Health,

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Table 1. Demographic characteristics and prevalence of knee pain in the Western Development Region of Nepal in 2013–2014, n (%)

Characteristics	Total	Knee pain	Chronic knee pain
Total	694 (100)	155 (22.3)	84 (12.1)
Men	329 (47.4)	71 (21.6)	36 (10.9)
Women	365 (52.6)	84 (23.1)	48 (13.2)
Age group, years			
18 - 34	297(42.7)	28 (9.4)	12 (3.5)
35 - 44	154 (22.3)	25 (16.2)	9 (7.7)
45 - 54	100 (14.4)	26 (26.0)	9 (7.4)
55 - 64	78 (11.2)	37 (47.4)	19 (23.1)
> 65	65 (9.4)	39 (60.0)	35 (43.3)
Landscape			
Ecological			
Plain	296 (42.7)	52 (17.3)	18 (6.1)
Hilly	300 (43.2)	72 (24.0)	40 (13.3)
Mountainous	98 (14.1)	31 (31.6)	26 (26.5)
Residency			
Urban	397 (57.2)	85 (21.4)	34 (8.6)
Rural	297 (42.8)	70 (23.6)	50 (16.8)
Occupation			
Non-agricultural	392 (56.5)	68 (17.3)	35 (8.9)
Agricultural	302 (43.5)	87 (28.8)	49 (16.2)
Employment status			
Employed	107 (15.4)	11 (10.3)	3 (2.8)
Self-employed	477 (68.7)	118 (24.7)	60 (12.6)
Unemployed	88 (11.7)	10 (11.4)	6 (6.8)
Unable to work	22 (3.2)	16 (72.7)	15 (5.6)
Education			
No school	92 (13.3)	36 (39.1)	25 (27.2)
1 to 5 years	228 (32.9)	57 (25.1)	33 (14.5)
6 to 10 years	266 (38.3)	42 (15.8)	15 (5.6)
> 10 years	108 (15.6)	20 (18.5)	11 (10.2)
Marital status			
Never married	144 (20.7)	13 (9.1)	7 (4.9)
Married	526 (75.8)	124 (23.6)	61 (11.5)
Widowed	24 (3.5)	18 (75.0)	16 (66.7)

because the areas were considered safe and accessible for the researcher. Seven study sites in the Western Development Region were selected across the three ecological landscapes: three from the plain ecological landscape, three from the hilly ecological landscape and one from the mountainous ecological landscape. Within each of the plain and hilly landscapes, one district was rural, one an urban deprived district and one an urban affluent district. These had been defined prior to selection of the study sites using National Census definition (10). Only one district was chosen in the mountainous ecological landscape because of the much smaller population and the lack of urban areas. Within each district, one municipality or ward was randomly selected, followed by a random selection of a village or Tole (the study site) within each of the municipalities/wards. Random selection of study sites was performed by giving a unique number to each municipality/ward and placing these in an opaque envelope from which one was drawn. This was repeated for the villages/Toles within the selected municipalities/wards.

A review of knee pain studies suggested that the 12-month period prevalence of knee pain can vary between 6% and 49% across countries and regions (4, 12). It was not possible to estimate the magnitude of clustering for this study à priori but we assumed a design effect of 2, which was large enough to err on the side of caution. Under this assumption, a sample of 100 per study site would give a total sample size of 300 participants in the hilly and plain landscapes, sufficient to estimate, with 95% confidence, a zonal prevalence of knee pain with a precision of within +/- 3.8% for the lowest estimate of 6% prevalence and +/- 8.0% for the highest estimate of 49% prevalence.

Intervention

To achieve the sample of 100 participants in each study site, the first household was randomly chosen from the publicly available electoral list of respective district electoral offices. Using a map of the respective areas, the subsequent households were chosen nearest to that first household in an interval of Nth households within the Tole/village in a randomly-selected direction where N was the total number of households in the enumeration district of the selected area divided by 20 (the number of households it was estimated need to be approached to achieve the sample in each site). This continued until 100 participants in that study site had agreed to participate. All adults in the household at the time of the field researcher's visit were approached to take part in the survey. Only those who had been resident in that landscape for more than six months were included. Information about the survey was read aloud to eligible participants and verbal consent was obtained and recorded.

Data collection

Study information was collected using a standardized questionnaire and delivered face-to-face by DK (first author), a native Nepali speaker. The questionnaire was developed first in English and then translated into Nepali using back and forward translation methods (13). The questionnaire was pretested among Nepalese nationals in the United Kingdom and piloted in another district in Nepal before being used in the study.

The questionnaire was used to collect data on age, sex, marital status, educational level and occupation of the participants. Questions on employment, marital and educational characteristics were directly derived from the National Census of Canada or of Nepal (10, 14). Presence of knee pain was assessed by asking the question: 'During the last 12 months, have you had any pain in or around either of your knee joints on most days for at least one month?' This question was chosen because it has been used in a number of large-scale published surveys of knee pain in populations (3, 4, 15). Presence of chronic knee pain was assessed by asking the above question and then 'If so, have you had the knee pain for three months or more'? Three months has been used by other researchers to define chronicity (16)

Data analysis

The 12-month period prevalence of knee pain was estimated as the number of people who reported they had knee pain for at least one month in the previous 12 months divided by the number of participants. The 12-month period prevalence rate of chronic knee pain was the number of people with knee pain, as above, who had the pain for at least three months divided by the number of participants.

The impact of clustering was investigated by estimating the inflation factor for each study site. The inflation factor

Table 2. Univariate logistic regression investigating the association of knee pain and chronic knee pain in the Western Development Region of Nepal in 2013 – 2014

Characteristics	Knee pain		Chronic knee pain	
	OR[1] (95% CI[2])	*p* value	OR[1] (95% CI[2])	*p* value
Gender		0.65		0.374
Men	1		1	
Women	1.1 (0.8 - 1.6)		1.2 (0.8 - 2.0)	
Age group, years		<0.001		<0.001
18 - 34	1		1	
35 - 44	1.9 (1.0 - 3.3)		1.5 (0.6 – 3.6)	
45 - 54	3.4 (1.9 - 6.1)		2.3 (1.0 - 5.8)	
55 - 64	8.7 (4.8 - 15.7)		7.6 (3.5 - 16.6)	
>65	14.4 (7.7 - 27.1)		27 (13.0 - 59.0)	
Landscape		<0.001		<0.001
Ecological	1		1	
Plain	1.5 (1.0 - 2.2)		2.4 (1.3 - 4.2)	
Hilly	2.2 (1.3 - 3.7)		5.6 (2.9 - 10.7)	
Residency		0.50		<0.001
Urban	1		1	
Rural	1.1 (0.8 - 1.6)		2.2 (1.4 - 3.4)	
Occupation		<0.001		<0.004
Non-agricultural	1		1	
Agricultural	1.9 (1.3 - 2.8)		2.0 (1.2 - 3.1)	
Employment status		<0.001		<0.001
Employed	1		1	
Self-employed	2.9 (1.5 - 5.5)		5.0 (1.5 – 16.2)	
Unemployed	1.1 (0.5 - 2.8)		2.5 (0.6 – 10.5)	
Unable to work	23.3 (7.5 - 71.8)		74.3 (17.3 – 318.9)	
Education		<0.001		<0.001
No school	3.4 (2.0 – 5.8)		6.2 (3.1 - 12.5)	
1 to 5 years	1.8 (1.1 -2.8)		2.8 (1.5 – 5.4)	
6 to 10 years	1.2 (0.7 - 2.2)		1.9 (0.8 - 4.3)	
> 10 years	1.2 (0.7 – 2.2)		1.9 (0.8 – 4.3)	
Marital status		<0.001		<0.001
Never married	1		1	
Married	3.1 (1.7 - 5.7)		2.6 (1.1 - 5.7)	
Widowed	30.2 (10.2 - 89.5)		39.1 (12.5 – 122.3)	

[1] Odds ratio; [2] 95% Confidence interval

is the estimate of the standard error divided by the estimate of the robust standard error. The robust standard error is the estimated standard deviation of cluster level prevalence estimates after adjusting for clustering. The inflation factors were mostly less than one or very close to one, suggesting there would be little impact from clustering and, hence, no adjustment for clustering was performed in the analyses.

It was also intended that prevalence rates would be estimated taking into account the multistage stratification (17). However, on review, there was under-sampling of households in one site (plain ecological landscape urban site) compared to the comparative size of the population, and this site had the lowest rates. As this could potentially bias the estimates, the analysis ignored the stratification introduced by the multistage aspect of the study design.

Weighted rates were estimated for the Region using ecological landscape-specific age and sex strata, and for each ecological landscape using age and sex strata; 95% confidence intervals were estimated for all prevalence rates using appropriate methods (18, 19). Binary logistic regression was applied to investigate whether ecological landscape was a potential independent risk factor for the prevalence of knee pain and chronic knee pain. Other potential risk factors included in the analysis were those that had a p-value less than 0.1 in univariate analysis or where there was evidence from the literature that they are important factors to consider, e.g., gender (20). All variables were categorical. For these analyses, the age of the participants was categorized into 18 - 34 years, 35 – 44 years, 45 – 54 years, 55 – 64 years and 65 years and over. Male gender, the 18 – 34 years age group, plain ecological landscape, urban area, non-agricultural work, employment elsewhere, 6 - 10 years schooling and never married variables were the selected reference groups because these had the lowest prevalence rates. Computed odd ratios (OR) with 95% confidence limits were used to compare and describe the association between potential risk factors and prevalence in the multivariate analysis.

RESULTS

There were 3954 households in the 7 study sites, of which 211 (5.3%) were visited to recruit a total of 694 participants: 296 (42.6%) from the hilly ecological landscape, 300 (43.2%) from the plain ecological landscape, and 98 (14.1%) from the mountainous ecological landscape. Of 700 adults approached, none refused to take part, but 6 of those approached had lived in the area less than six months and were excluded. A total of 155 (22.3%) participants reported knee pain lasting for at least a month in the last 12 months and 84 (12.1%) reported knee pain (knee pain persisting for more than three months in the previous 12 months). The socio-demographic characteristics of the participants and crude prevalence rates by characteristic are shown in table 1.

In univariate analyses (table 2), the crude prevalence of knee pain was significantly higher in older participants ($\chi2$ = 114.1, df 4, p<0.001), those working in agriculture ($\chi2$ = 12.9, df 1, p<0.001) and significantly differed across ecological landscapes (χ^2 = 9.2, df 2, p<0.001). Crude chronic knee prevalence rates also significantly differed across these factors but in addition, there was a higher rate of chronic knee pain in those living in rural compared to urban areas (χ^2 = 10.9, df 1, p<0.001). For all other factors in both analyses, the p-value was greater than 0.1 except for gender (table 2). However, gender was also retained in the multivariate analysis because other studies suggest it is an important factor (3, 7, 12, 21, 22).

In the multivariate analyses, ecological landscape was an independent risk factor for both knee pain and chronic pain after adjustment for the other factors (table 4). For those living in the mountainous landscape, the odds of knee pain were 3 times higher, and for chronic knee pain, nearly 9 times higher, than those living in the plain landscape (table 3). Older age and working in agriculture also remained as independent risk factors for both knee pain and chronic knee pain when adjusted for all other factors (table 3). As ecological landscape and working in agriculture may be synergistic, an interaction term for living in the hilly landscape and working in agriculture was subsequently considered for inclusion in the multivariate analyses. Only hilly landscape was chosen, as almost all those in the mountainous landscape work in agriculture. This interaction was not statistically significant (p=0.4) and its inclusion did not change the interpretation of the model shown in table 3.

Table 3. Multivariate logistic regression investigating the association of knee pain and chronic knee pain in the Western Development Region of Nepal in 2013 – 2014

Characteristics	Knee pain		Chronic knee pain	
	OR[1] (95% CI[2])	p value	OR[1] (95% CI[2])	p value
Gender		0.44		0.18
Men	1		1	
Women	1.2 (0.8 - 1.8)		1.5(0.8 - 2.6)	
Age group, years		<0.001		<0.001
18 - 34	1		1	
35 - 44	1.5 (0.8 - 2.8)		1.1 (0.4 – 2.9)	
45 - 54	2.7 (1.3 - 5.4)		2.1 (0.7 - 6.2)	
55 - 64	7.1 (3.5 – 14.4)		7.5 (2.8 – 20.4)	
>65	8.1(3.4 - 19.1)		23.4 (7.8 – 70.7)	
Landscape				
Ecological		<0.009		<0.001
Plain	1		1	
Hilly	1.2 (0.8 - 1.9)		2.1 (1.0 – 4.3)	
Residency	3.0 (1.5 - 6.0)		9.1 (3.6 – 23.0)	
Urban		0.18		0.42
Rural	1		1	
Occupation	0.7 (0.4 – 1.2)		1.4 (0.7 – 2.8)	
Non-agricultural		0.029		0.13
Agricultural	1		1	
Landscape	1.8 (1.1 - 3.1)		1.9 (0.8 – 4.2)	
Employment status		0.20		0.17
Employed	1		1	
Self-employed	1.5 (0.7 – 3.4)		2.4 (0.6 – 10.5)	
Unemployed	2.5 (0. 7 – 8.5)		4.4 (0.6 – 30.4)	
Unable to work	4.0 (1.0. – 6.4)		7.0 (1.1 – 43.3)	
Education	0.31			0.08
No school	0.5 (0.3 -1.1)		0.9 (0.4 – 2.0)	
1 to 5 years	0.4 (0.2 – 1.2)		3.1 (1.2 – 8.3)	
6 to 10 years	0.4 (0.2 – 1.2)		3.1 (1.2 – 8.3)	
> 10 years	0.5 (0.3 – 1.1)		0.7 (0.3 – 1.8)	
Marital status		0.16		0.26
Never married	1		1	
Married	1.9 (0.7 – 5.3)		1.9 (0.4 – 9.0)	
Widowed	4.3 (0.1 – 19.1)		4.4 (0.6 – 30.1)	

[1] Odds ratio; [2] 95% Confidence interval

DISCUSSION

This is the first study to estimate the prevalence of knee pain and chronic knee pain in adults of three ecological landscapes of a region in Nepal. The survey suggests that one in five residents of the Western Development Region of Nepal have knee pain and one in ten have chronic knee pain. The 12-month period prevalence of knee pain and chronic knee pain was higher than that reported for some high-income countries (22).

As expected, older age was an important risk factor in the Nepalese population, but cannot explain the higher prevalence rates observed compared to developed countries, because Nepal tends to have a younger population. The multivariate analysis suggests that employment in agriculture, which is high in the Nepalese population, and living in the mountainous landscape are important contributors. Although only 7% of the population live in the mountainous landscape (10), the risk of knee pain, particularly of chronic pain, was substantially greater. Others have found similar prevalence rates of knee pain in those living in mountainous terrain (3, 8), but only the study by Sakakibara et al. investigated mountainous terrain as a risk factor (7). They found that it was only a risk factor in men. We did not find that rates of knee pain differed significantly between men and women, even in the mountainous landscape (27.4% vs. 31.6% respectively; χ^2 = 0.456, df 1, p=0.499). Although many studies suggest higher rates in women (3, 8), this is not exclusively the case, and studies in countries surrounding Nepal have also reported similar rates in men and women (23, 24). This may be because both genders undertake tasks which can lead to damage to the structure of the knee, leading to the development of knee pain, such as agricultural employment, occupational and leisure squatting and kneeling, lifting and carrying of heavy weights and walking for long periods (25, 26). The prevalence of knee pain in the study by Sakiakibara et al. was also lower than that observed in our study (7). This could be because of the difference in altitude and steepness of the terrain. Those living in mountainous areas in Nepal, live in the highest mountainous landscape in the world. As well as the terrain, exposure to cold weather might contribute to high rates in mountainous areas. In the spring and winter, temperatures in Nepal can go from around 150 to 200 C^{o} in the day to less than 00 C^{o} at night. Epidemiological studies suggest that musculoskeletal pain can be worse in the cold (27).

Another interesting observation is that while the odds of knee pain were 3 times higher in the mountainous ecological landscape compared to the plain ecological landscape, the relative difference for chronic pain was even greater (odds ratio 8.8). Access to health services, particularly specialist services, is more difficult for those living in mountainous regions of Nepal. This survey also examined help seeking behavior and levels of disability related to knee pain and this will be the focus of a further publication.

The response rate to this survey was very high. All those asked to participate agreed, this was in part due to the field researcher establishing good relationships with local community leaders before commencing the survey in each site. However, there are limitations. Because of safety concerns, the study was only undertaken in one Region. However, all Regions in Nepal have plain, hilly and mountainous landscapes. Furthermore, the field researcher only collected data between 10 am and 5 pm, and, therefore, there is a possibility of selection bias, since those at home may have more chronic conditions. Another study limitation is that the analysis was unable to fully utilize the survey design, due to the under-sampling of households in plain landscape compared to mountainous landscape. Although, this might affect the precision of the prevalence estimates slightly, the estimates themselves are likely to be robust as the survey and weighted prevalence rates did not differ much, suggesting the sample age-sex distribution was similar to that of the Region.

CONCLUSIONS

Knee pain is prevalent in Nepalese populations with over one in five of the population suffering from knee pain and one in ten from chronic knee pain. The prevalence of knee pain and chronic knee pain was highest in the mountainous landscape compared to the hilly and plain landscapes of the

Western Development Region of Nepal. Further research is needed to understand the reasons for much higher rates in mountainous landscape. These findings have implications for policymakers in Nepal who may wish to target more services to areas of greater need and consider preventative action.

REFERENCES

1. Litwic A, Edwards M, Dennison E, Cooper C. Epidemiology and Burden of Osteoarthritis. Br Med Bull. 2013 Jan;105:185–99.
2. Hay SI, Abajobir AA, Abate KH, Abbafati C, Abbas KM, Abd-Allah F, et al. Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet [Internet]. 2018 Feb 28;390(10100):1260–344. Available from: http://dx.doi.org/10.1016/S0140-6736(17)32130-X
3. Muraki S, Oka H, Akune T, Mabuchi A, En-yo Y, Yoshida M, et al. Prevalence of radiographic knee osteoarthritis and its association with knee pain in the elderly of Japanese population-based cohorts: The ROAD study. Vol. 17, Osteoarthritis and Cartilage. 2009. p. 1137–43.
4. Chokkhanchitchai S, Tangarunsanti T, Jaovisidha S, Nantiruj K, Janwityanujit S. The effect of religious practice on the prevalence of knee osteoarthritis. Clin Rheumatol. 2010 Jan;29(1):39–44.
5. Ackerman IN, Osborne RH. Obesity and increased burden of hip and knee joint disease in Australia: Results from a national survey. BMC Musculoskelet Disord [Internet]. 2012 Dec 20;13:254. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3564744/
6. Silverwood V, Blagojevic-Bucknall M, Jinks C, Jordan JL, Protheroe J, Jordan KP. Current evidence on risk factors for knee osteoarthritis in older adults: a systematic review and meta-analysis [Internet]. Vol. 23, Osteoarthritis Cartilage. 2015. p. 507–15. Available from: http://www.sciencedirect.com/science/article/pii/S1063458414013429
7. Sakakibara H, Zhu SK, Furuta M, Kondo T, Miyao M, Yamada S, et al. Knee pain and its associations with age, sex, obesity, occupation and living conditions in rural inhabitants of Japan. Vol. 1, Environ Health Prev Med. 1996. p. 114–8.
8. Hoy DG, Fransen M, March L, Brooks P, Durham J, Toole MJ. In rural Tibet, the prevalence of lower limb pain, especially knee pain, is high: an observational study. J Physiother. 2010 Jan;56(1):49–54.
9. World Atlas. Nepal Geography [Internet]. World Atlas. 2017. Available from: http://www.worldatlas.com/webimage/countrys/asia/nepal/npland.htm
10. GoN. National population and housing census 2011 (National report). 2012;01:1–270.
11. Baidya S, Khadgi B, Acharya R. Disability Themed Community Diagnosis of Rural Population in Dhulikhel: a Different Standpoint. Int J … [Internet]. 2015;7(23):14–20. Available from: http://search.proquest.com/openview/3b49c1b0425147b4370eab80bed2f74a/1?pq-origsite=gscholar&cbl=1926339
12. Gibson T, Hameed K, Kadir M, Sultana S, Fatima Z, Syed a. Knee pain amongst the poor and affluent in Pakistan. Br J Rheumatol. 1996;35(2):146–9.
13. Brislin RW. Back-Translation for Cross-Cultural Research. J Cross Cult Psychol [Internet]. 1970 Sep 1;1(3):185–216. Available from: https://doi.org/10.1177/135910457000100301
14. Minister of Industry. Analytical document The Canadian Population in 2011 : Population Counts and Growth Population and dwelling counts , 2011 Census. 2012;(98):1–24.
15. Kim IJ, Kim HA, Seo Y-I, Jung YO, Song YW, Jeong JY, et al. Prevalence of knee pain and its influence on quality of life and physical function in the Korean elderly population: a community based cross-sectional study. J Korean Med Sci [Internet]. 2011;26(9):1140–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21935267%5Cnhttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3172649
16. Jinks C, Lewis M, Ong BN, Croft P. A brief screening tool for knee pain in primary care. 1. Validity and reliability. Vol. 40, Rheumatology. 2001.
17. Sedgwick P. Multistage sampling. BMJ [Internet]. 2015;351. Available from: http://www.bmj.com/content/351/bmj.h4155
18. Altman DG, Gardner MJ (Martin J. Statistics with confidence : confidence intervals and statistical guidelines. [Internet]. 2000. p. 240. Available from: https://www.wiley.com/en-us/Statistics+with+Confidence%3A+Confidence+Intervals+and+Statistical+Guidelines%2C+2nd+Edition-p-9780727913753
19. Guo H-R. Age adjustment in ecological studies: using a study on arsenic ingestion and bladder cancer as an example. BMC Public Health [Internet]. 2011;11(1):820. Available from: https://doi.org/10.1186/1471-2458-11-820
20. Hair JF. Multivariate data analysis. (7th edition). 2010.
21. Kim IJ, Kim HA, Seo YI, Jung YO, Song YW, Jeong JY, et al. Prevalence of knee pain and its influence on quality of life and physical function in the Korean elderly population: a community based cross-sectional study. J Korean Med Sci. 2011;26(9):1140–6.
22. Mabey T, Honsawek S, Mabey T, Honsawek S. Role of Vitamin D in Osteoarthritis: Molecular, Cellular, and Clinical Perspectives. Int J Endocrinol. 2015;2015:383918.
23. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian J Orthop [Internet]. 2016 Sep;50(5):518–22. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5017174/
24. Chia YC, Beh HC, Ng CJ, Teng CL, Hanafi NS, Choo WY, et al. Ethnic differences in the prevalence of knee pain among adults of a community in a cross-sectional study. BMJ Open [Internet]. 2016 Dec 1;6(12):e011925. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5168635/
25. Amin S, Goggins J, Niu J, Guermazi A, Grigoryan M, Hunter DJ, et al. Occupation-related squatting, kneeling, and heavy lifting and the knee joint: A magnetic resonance imaging-based study in men. Vol. 35, Journal of Rheumatology. 2008. p. 1645–9.
26. Dahaghin S, Tehrani-Banihashemi SA, Faezi ST, Jamshidi AR, Davatchi F. Squatting, sitting on the floor, or cycling: Are life-long daily activities risk factors for clinical knee osteoarthritis? Stage III results of a community-based study. Arthritis Care Res. 2009;61(10):1337–42.
27. Macfarlane T V, McBeth J, Jones GT, Nicholl B, Macfarlane GJ. Whether the weather influences pain? Results from the EpiFunD study in North West England. Rheumatology [Internet]. 2010 Aug 1;49(8):1513–20. Available from: http://dx.doi.org/10.1093/rheumatology/keq099

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